# METHOD FOR INLINE PRODUCTION OF SMOOTH SURFACE BOARD

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## TECHNICAL FIELD

This invention relates to a method for curing fibrous mineral material in an oven. More particularly, this invention relates to a method for the inline production of smooth surface board from fibrous mineral material.

## BACKGROUND OF THE INVENTION

It is common practice in the manufacture of formed composite boards, such as a ceiling tile or an acoustic panel, to pass mineral fiber insulation between a pair of foraminous conveyors, or belts, mounted for travel through the curing oven. Hot gases are passed through the insulation to more effectively cure the binder in the insulation. Associated with the oven are flows of hot curing gases, usually air, which travel generally upwardly or downwardly through the insulation. A common construction for the belts is that of foraminous flights connected in series and driven by a chain. The ends of the flights are mounted on wheels which ride in tracks running the length of the oven.

At the beginning of the curing process, the uncured and therefore unhardened surfaces of the pack can be pressed into the openings in the foraminous flights. This pressing causes an undesirable embossing of the pattern of the flight surface onto the finished boards. In response to such embossing, composite boards having a smooth surface on one side can be provided by many known methods, including skidding, wherein upper and lower oven conveyors are run at slightly different speeds, and the faster conveyor skids over the surface of

the pack, smoothing that surface. However, it is desired to provide an improved method for forming smooth surface board from fibrous mineral material.

## SUMMARY OF THE INVENTION

This invention relates to an improved method for manufacturing smooth surface board from fibrous material. The method includes moving fibrous material through an oven on a first conveyor assembly to produce a board of fibrous material. The first conveyor assembly includes a first upper conveyor and a first lower conveyor. The board of fibrous material is then pulled from the oven with a pulling apparatus downstream of the oven. The board of fibrous material is preferably pulled at a speed different from the speed of at least one of the first upper conveyor and the first lower conveyor, causing the fibrous material to skid relative to the at least one of the first upper conveyor and the first lower conveyor, and thereby resulting in a smooth surface board.

Another embodiment of the method for manufacturing smooth surface board from fibrous material includes moving fibrous material through an oven on a first conveyor assembly to produce a board of fibrous material. The first conveyor assembly includes a first upper conveyor and a first lower conveyor. One of the first upper conveyor and the first lower conveyor are driven at a speed faster relative to the other of the first upper conveyor and the first lower conveyor. The board of fibrous material is then pulled from the oven with a pulling apparatus downstream of the oven. The board of fibrous material is preferably pulled at a speed different from the speed of least one of the first upper conveyor and the first lower conveyor, causing the fibrous material to skid relative to the at least one of the first upper conveyor and the first lower conveyor, and thereby resulting in a smooth surface board.

Various objects and advantages of this invention will become apparent to those skilled in the art from the following detailed description of the preferred embodiments, when read in light of the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic elevational view of an apparatus for forming smooth surface board from fibrous material according to the invention.

Fig. 2 is a schematic elevational view of an alternate embodiment of the pulling apparatus illustrated in Fig. 1.

## DETAILED DESCRIPTION AND PREFERRED EMBODIMENTS OF THE INVENTION

Referring now to the drawings, there is shown in Fig. 1 an apparatus 10 for manufacturing a smooth surface board 12 according to the invention. In the illustrated manufacturing process, molten glass is supplied from a furnace (not shown) via a forehearth (not shown) to a fiberizer 14. Binder applicators 16 then apply, preferably by spraying, a binder on the veils of fibers 18 produced by the fiberizer 14. The fibers are collected as pack 20 on a collection conveyor 22. The binder can be a phenol-formaldehyde binder, or any other desired type of binder. It will be appreciated that the pack 20 can be produced by any desired alternate method, many of which are known in the art.

The uncured pack 20 is then passed through an oven 24 on a first conveyor assembly 25. Preferably, the uncured pack 20 is passed through the oven 24 between a first lower conveyor 26 and a first upper conveyor 28 of the first conveyor assembly 25, and emerges as the cured smooth surface board 12. Since the apparatus of the invention is primarily used for manufacturing board products having a smooth surface, the cured fibrous material will be referred to as smooth

surface board. The pack 20 is cured within the oven 24 by hot curing gases, such as hot air. The hot curing gases can be supplied to the oven 24 from a source of hot gas (not shown) via a supply duct 30. The curing gases can be removed from the oven 24 via an exhaust duct 32.

The first lower conveyor 26 and the first upper conveyor 28 are preferably foraminous, such as foraminous belts, although such foraminous belts are not required. Any conveyor means suitable for carrying the uncured pack 20 through the oven 24, while enabling the flow of curing gases through the pack 20, can be used for the conveyors 26 and 28. The first lower conveyor 26 and the first upper conveyor 28 are preferably moved in the direction of the arrow 33 by motors 34 and 36, respectively.

At the beginning of the curing process, the uncured and therefore unhardened surfaces of the pack can be pressed into the openings in the foraminous belts of the conveyors 26 and 28. This pressing can cause undesirable embossing of the pattern of belt surfaces 38 and 40, respectively, onto the finished board 12.

To prevent such embossing, and to produce a board 12 having at least one relatively smooth face, a smoothing process, herein after referred to as skidding, can be used. It will be understood that skidding will refer to the process of moving or driving one conveyor, such as the first upper conveyor 28, at a speed faster relative to the first lower conveyor 26. The first upper conveyor 28 thereby also moves at a speed faster relative to the upper surface 20A of the pack 20. Accordingly, the surface 40 of the first lower conveyor 26 moves the pack 20 in the direction of the arrow 33, while the surface 38 of the first upper conveyor 28 moves faster, or skids, relative to an upper surface 20A of the pack 20. Preferably,

the surface 38 of the first upper conveyor 28 moves within the range of from about 0.4 to about 4.0 percent faster relative to the speed of the first lower conveyor 26.

Such skidding smoothes the upper surface 20A of the pack 20. It will be understood that such skidding can also be provided by driving the first lower conveyor 26 at a speed faster relative to the first upper conveyor 28. Preferably, the belt surfaces 38 and 40 are substantially non-gripping, such that either or both of the conveyors 26 and 28 can skid relative to the respective surfaces of the pack 20.

Applying a mat facing 42 to a surface of the pack 20 can enhance the smoothing effect caused by the relatively faster moving conveyor 28. If desired, the mat facing 42 can be applied to the upper surface 20A of the pack 20, as shown in Fig. 1. The mat facing 42 can be any desired mat facing such as polyester/glass mat. Although the mat facing 42 is shown only being applied to the upper surface 20A of the pack 20 in Fig. 1, it will be understood that the mat facing 42 can also be applied to a lower surface 20B of the pack 20, or can be applied to both the surfaces 20A and 20B of the pack 20.

A pulling apparatus or second conveyor assembly 46 is provided downstream of the oven 24. As shown in Fig. 1, the second conveyor assembly 46 includes a second lower conveyor 48 and a second upper conveyor 50. The second lower conveyor 48 and the second upper conveyor 50 are preferably moved in the direction of the arrows 52 and 54 by motors 56 and 58, respectively. Preferably, the second lower conveyor 48 and the second upper conveyor 50 of the second conveyor assembly 46 provide sufficient pressure and/or surface area relative to the smooth surface board 12, so as to not skid or slip when engaging the smooth surface board 12.

The second lower conveyor 48 and the second upper conveyor 50 are preferably formed of any flexible belt material. More preferably, conveyor surfaces 60 and 62, respectively, of the second lower conveyor 48 and the second upper conveyor 50 are gripping surfaces. As used herein, such a gripping surface is defined as having a coefficient of friction greater relative to the coefficient of friction of the surfaces 38 and 40 of the first lower conveyor 26 and the first upper conveyor 28, respectively. It will be understood that the second conveyor assembly 46 can be positioned at any desired distance d from the oven 24 and the first conveyor assembly 25 to provide sufficient support to the smooth surface board 12.

In operation, the pack 20 enters an inlet end 64 of the oven 24 where the pack 24 is compressed and cured as herein described. The cured pack 20 then exits an outlet end 66 of the oven as the smooth surface board 12. Preferably, the smooth surface board 12 is relatively rigid and dense, such as for example, a board having a density within the range of from about 2 pounds per cubic foot to about 8 pounds per cubic foot.

After curing in the oven 24, a second layer of material, such as a foil-scrim-kraft (FSK) layer 44, or a layer of any desired material (not shown), can be applied to the lower surface 20B (as viewed in Fig. 1) of the smooth surface board 12, as shown in Fig. 1. Any desired conventional adhesive can be used to adhere the FSK layer 44 to the smooth surface board 12. It will be understood that the FSK layer 44 can also be applied to the upper surface 20A of the pack 20, or can be applied to both the surfaces 20A and 20B of the pack 20. Although the FSK layer 44 is illustrated in Fig. 1 as being applied to the smooth surface board 12 upstream of the second conveyor assembly 46, it will be understood that the FSK layer 44 can also be applied downstream of the second conveyor assembly 46.

The second conveyor assembly 46 is driven at a speed different from the speed of the speed of at least one of the first lower conveyor 26 and the first upper conveyer 28. Preferably, the second conveyor is driven at a speed different from the speed of both the first lower conveyor 26 and the first upper conveyer 28.

By controlling the speed of the smooth surface board 12 with the second conveyor assembly 46, the speed of the pack 20 through the oven 24 and thereby the smoothing of the pack surfaces 20A and 20B, can also be controlled. For example, by driving the second conveyor assembly 46 at a speed substantially equal to the speed of the slowest conveyor (i.e., the first lower conveyor 26) of the first conveyor assembly 25, the lower surface 20B of the pack 20 is engaged by and carried on the first lower conveyor 26, while the first upper conveyor 28 skids along the upper surface 20A of the pack 20.

Alternately, the second conveyor assembly 46 can be driven at a speed faster relative to both the speed of the first lower conveyor 26 and the first upper conveyor 28. By moving the smooth surface board 12 at a speed faster than both the first lower conveyor 26 and the first upper conveyor 28, the first lower conveyor 26 and the first upper conveyor 28 are then caused to skid along the relatively faster moving lower and upper surfaces 20A and 20B of the pack 20, respectively. The lower and upper surfaces 20A and 20B of the pack 20 are thereby both smoothed.

Additionally, the second conveyor assembly 46 can be driven at a speed slower relative to both the speed of the first lower conveyor 26 and the first upper conveyor 28. By moving the smooth surface board 12 at a speed slower than both the first lower conveyor 26 and the first upper conveyor 28, the first lower conveyor 26 and the first upper conveyor 28 are then also caused to skid along the relatively slower moving lower and upper surfaces 20A and 20B of the pack 20,

respectively. The lower and upper surfaces 20A and 20B of the pack 20 are thereby both smoothed.

An alternate embodiment of the pulling apparatus is shown generally at 68 in Fig. 2. The pulling apparatus 68 includes at least one wheel 70 having a plurality of spikes 72 for engaging at least one surface of the smooth surface board 12. The method of operation of the pulling apparatus 68 is substantially identical to the method of operation of the pulling apparatus or second conveyor assembly 46, and will not be described herein. It will be understood, however, that the method of the invention can be satisfactorily performed with any desired pulling apparatus.

The principle and mode of operation of this invention have been described in its preferred embodiments. However, it should be noted that this invention may be practiced otherwise than as specifically illustrated and described without departing from its scope.